

**REMARKS**

Favorable reconsideration of this application in light of the following discussion is respectfully requested.

Claims 1-19 are presently active in this case. The present Amendment amends Claims 1-19 without introducing any new matter.

The outstanding Office Action rejected Claim 19 under 35 U.S.C. §102(e) as anticipated by Cho et al. (U.S. Publication No. 2004/0114087, herein “Cho”). Claims 1, 3-7, 9-13 and 15-18 were rejected under 35 U.S.C. §103(a) as unpatentable over Manabe et al. (U.S. Patent No. 6,570,639, herein “Manabe”) in view of Cho. Claims 2, 8 and 14 were rejected under 35 U.S.C. §103(a) as unpatentable over Manabe and Cho in view of Nishida et al. (U.S. Patent No. 6,842,207, herein “Nishida”).

In order to correct minor formalities and to better comply with U.S. claim drafting practice, Claims 1-19 are amended. Claim 19 is further amended to replace “size” with “cross-sectional area” and “wherein the cross-sectional area is in a plane parallel to the substrate.” These features find non-limiting support in the disclosure as originally filed, for example from page 16, line 27 to page 17, line 11.

In response to the rejection of Claim 19 under 35 U.S.C. §102(e) over Cho, Applicant respectfully requests reconsideration of this rejection and traverses the rejection, as discussed next.

Briefly recapitulating, Applicant’s invention, as recited in Claim 19, relates to a method of manufacturing a liquid crystal display apparatus including a liquid crystal layer interposed between a first substrate and a second substrate. The method includes the steps of: forming a spacer material on the first substrate; patterning the spacer material with a first cross-sectional area in accordance with a first gap region that includes a first gap for interposition of the liquid crystal layer and patterning the spacer material with a second cross-

sectional area, which is smaller than the first cross-sectional area, in accordance with a second gap region that includes a second gap, which is smaller than the first gap; *melting the spacer material* that is patterned in each of the first gap region and the second gap region *to adjust a height* of the spacer material patterned in the first gap region and a height of the spacer material patterned in the second gap region.

To facilitate the understanding of the Applicants' invention, the present invention as disclosed in the Specification is next explained. Applicant's invention takes advantage of a phenomenon wherein the height of the spacer decreases by melting the spacer, and the height reduction depends on the cross-section of the spacer to be molten. In particular, the height of the spacer of greater cross-section is hardly changed or slightly decreased if it is molten, while the height of the spacer of smaller cross-section is remarkably decreased if it is molten.<sup>1</sup> The invention of Claim 19 takes advantage of the phenomenon by adjusting the heights of the spacer materials in accordance with the first gap and second gap.

Turning now to the applied references, Cho teaches a panel assembly for a liquid crystal display with a plurality of spacers for supporting the panel.<sup>2</sup> However, Cho does not disclose Applicant's claimed patterning of the spacer material with a first cross-sectional area to form a first gap and patterning the spacer material with a second cross-sectional area smaller than the first cross-sectional area to form a second gap smaller than the first gap, and also does not teach or suggest the melting of the patterned spacer materials to adjust heights of the spacer materials. Cho discloses a patterning method,<sup>3</sup> however does not teach or suggest different cross-sectional areas at patterning. Cho's spacers 321, 322 and 323 all have the same cross-sectional area.<sup>4</sup> In addition, Cho does not disclose Applicant's claimed melting the spacer material to adjust a height of the spacer material of a first cross-sectional

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<sup>1</sup> See Applicant's Specification at page 18, lines 3-19 and in corresponding Figure 5.

<sup>2</sup> See Cho in the Abstract.

<sup>3</sup> See Cho in Figures 14 and 15.

<sup>4</sup> See Cho in Figures 12-15.

area patterned in the first gap region, and a height of the spacer material with a second-cross sectional area patterned in the second gap region.

Accordingly, Applicant believes that Cho does not teach or suggest all the features of Claim 19. Therefore, Applicant respectfully traverses the rejection and requests reconsideration of the rejection of Claim 19.

In response to the rejection of Claims 1, 3-7, 9-13 and 15-18 under 35 U S C. §103(a) over Manabe in view of Cho and the rejection of Claims 2, 8 and 14 under 35 U S C. §103(a) over Manabe and Cho in view of Nishida, Applicant respectfully traverses these rejections and requests reconsideration of the rejections, as discussed next.

Manabe discloses a liquid display device including a pair of substrates with a shield pattern that is made of a resin of predetermined thickness.<sup>5</sup> However, Manabe fails to teach or suggest Applicant's claimed first and second gap region, with a second gap smaller than the first gap; a first columnar spacer formed in the first gap region; and a second columnar spacer formed in the second gap region, wherein a contact area of the first columnar spacer is greater than a contact area of the second columnar spacer, as recited in independent Claim 1. Independent Claims 7 and 13 recite similar features to recite "wherein a dimension of the first columnar spacer is greater than a dimension of the second columnar spacer" (Claim 7) and "wherein a volume of the first columnar spacer is greater than a volume of the second columnar spacer" (Claim 13).

Applicant respectfully submits that in Manabe, a blue pixel, a green pixel and a red pixel have a gap of equal thickness, and the color filter layers 24G, 24B and 24R have an equal thickness of 3 $\mu$ m.<sup>6</sup> Accordingly, Manabe's gaps of liquid crystal layer formed by two spacers 31 are of equal thickness.<sup>7</sup>

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<sup>5</sup> See Manabe in the Abstract.

<sup>6</sup> See Manabe at column 4, lines 13-15.

<sup>7</sup> See Manabe at column 7, lines 58-59 and in Figures 1A and 3.

The reference Cho does also not remedy the deficiencies of the reference Manabe. In particular, Cho does not teach or suggest Applicant's claimed contact area of the first columnar spacer being greater than a contact area of the second columnar spacer, in accordance with the difference of the gap thicknesses of the liquid crystal layer. Cho's spacers 322 and 321 are applied to regions with different gap thicknesses of the liquid crystal layer.<sup>8</sup> According to one embodiment of Cho, spacer 322 with a smaller contact area than spacer 321 is arranged in a region of a bigger gap and spacer 321 with a bigger contact area is arranged in the region of a smaller gap.<sup>9</sup> Spacer 322 is higher than spacer 321. Accordingly, the relationship between the gap of the liquid crystal layer and the contact area of the spacers is *opposite* to features claimed by Applicant's independent Claims 1, 7 and 13.

Furthermore, in another embodiment of Cho, the spacers 321, 322 and 323 are formed in respective regions with different gap thickness of the liquid crystal layer.<sup>10</sup> The spacers are also different in each contact area.<sup>11</sup> However, Cho further teaches that “[t]he different contact areas of the spacers 321-323 are also obtained by forming spacer columns having different thicknesses with or without the different thicknesses of the color filters 230 and by pressing the spacer columns such that the top surfaces of the spacer columns have the same height.”<sup>12</sup> In other words, since the gap of the region formed at spacer 321 is the smallest gap and spacer 321 is the highest spacer,<sup>13</sup> spacer 321 will be the most pressed of all spacers 321-323. Consequently, the contact area will become the biggest of all spacers 321-323. Accordingly, the relationship between the gap of the liquid crystal layer and the contact area of the spacer in Cho are *opposite* to Applicant's claims and therefore Cho teaches away from Applicant's invention.

<sup>8</sup> See Cho in Figure 3.

<sup>9</sup> See Cho for example in paragraphs 52-53 and in corresponding Figure 3.

<sup>10</sup> See Cho in Figure 12.

<sup>11</sup> See Cho for example at page 6, paragraphs 116 and 121.

<sup>12</sup> See Cho at page 6, paragraph 121.

<sup>13</sup> See Cho for example in Figure 13.

Further, in the reference Nishida, all the spacers 26 are formed on the black matrix and are equal in height.<sup>14</sup> Nishida teaches that the granular spacer may be sprayed to control the thickness of the liquid crystal layer.<sup>15</sup> Nishida therefore also does not remedy the deficiencies of the references Manabe and Cho, since Nishida does not teach or suggest a contact area of the first columnar spacer being greater than a contact area of the second columnar spacer, as claimed by Applicant.

Therefore, even if the combination of Manabe, Cho and/or Nishida is assumed to be proper, the combination fails to teach every element of the claimed invention. Specifically, the combination fails to teach the claimed first and second gap region, with a second gap smaller than the first gap; a first columnar spacer formed in the first gap region; and a second columnar spacer formed in the second gap region, wherein a contact area of the first columnar spacer is greater than a contact area of the second columnar spacer. Accordingly, Applicant respectfully traverses, and requests reconsideration of, these rejections based on these patents.<sup>16</sup>

Consequently, in view of the present Amendment, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal Allowance. A Notice of Allowance for Claims 1-19 is earnestly solicited.

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<sup>14</sup> See Nishida for example in Figures 12A-C and 18.

<sup>15</sup> See Nishida for example at column 19, lines 5-17.

<sup>16</sup> See MPEP 2142 stating, as one of the three "basic criteria [that] must be met" in order to establish a *prima facie* case of obviousness, that "the prior art reference (or references when combined) must teach or suggest all the claim limitations," (emphasis added). See also MPEP 2143.03: "All words in a claim must be considered in judging the patentability of that claim against the prior art."

Should the Examiner deem that any further action is necessary to place this application in even better form for allowance, the Examiner is encouraged to contact Applicant's undersigned representative at the below listed telephone number.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,  
MAIER & NEUSTADT, P.C.



Eckhard H. Kuesters  
Attorney of Record  
Registration No. 28,870

Customer Number  
**22850**

Tel: (703) 413-3000  
Fax: (703) 413 -2220  
(OSMMN 06/04)

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